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THE TOBACCO MOTH AS A PEST IN GROWERS' PACK HOUSES IN NORTH CAROLINA AND VIRGINIA [1]

By C. F. Stahl and W. A. Thomas, Division of
Truck Crop and Garden Insect Investigations

The tobacco moth (Ephestia elutella (Hbn.)) has been known in the United States for more than 40 years and has been recognized as an important pest of stored tobacco since 1930. It was not until 1938, however, that it became important as a pest of cured tobacco in farmers' pack houses. The first records of infestations in the pack houses were received in 1937, when specimens from two localities in North Carolina were identified. Since investigation of reports received in 1938 showed that infestations were widely scattered in North Carolina, a survey was conducted during September for the purpose of determining the extent and severity of the infestations. This survey was followed in 1939 by a more extensive one, which included all the flue-cured tobacco producing belts. From 1939 to 1942 intensive investigations were conducted in heavily infested districts to determine the best methods of protecting the tobacco. The information contained in this publication is based primarily on investigations conducted by W. D. Reed and J. P. Vinzant in the Reidsville, N. C., district during the period 1939-40 and by the authors in the Farmville, N. C., district during 1940-42.

EXTENT OF INFESTATION

The survey in September 1938, which covered portions of the flue-cured tobacco producing districts of South Carolina, North Carolina, and Virginia, revealed moderate to heavy infestations of the tobacco moth in pack houses in the counties of Durham, Rockingham, Forsyth, and parts of Granville and Wake in North Carolina, and in Pittsylvania County in Virginia. The insect was present in some pack houses, but causing little damage, in Johnston, Chatham, Person, Caswell, Orange, Pitt, Lenoir, and Wilson Counties of North Carolina. The pack houses examined in South Carolina showed no evidence of infestation.

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[1] This publication is a revision of and supersedes E-450, which was issued in 1938, as well as an unnumbered publication of this Bureau by W. D. Reed and J. P. Vinzant (no date) entitled "The tobacco moth, a new pest on the farm, and recommendations for its control."

During the 1939 survey no infestations were found in the pack houses in the flue-cured tobacco producing belts of Georgia or South Carolina. Moderate to heavy infestations were observed in the Eastern, Middle, and Old Belts of North Carolina and Virginia, where tobacco is grown for flue-curing. The heaviest infestations were located in the immediate vicinity of Farmville, Durham, Reidsville, and Winston-Salem in North Carolina, and of Danville, Va. Light to moderate infestations were centered around Wendell, Fuquay-Varina, Oxford, Wilson, Rocky Mount, Greenville, and Kinston in North Carolina. Infestations were found in the counties of Pitt, Lenoir, Wilson, Edgecombe, Nash, Greene, Johnston, Franklin, Wake, Granville, Durham, Chatham, Orange, Person, Caswell, Rockingham, Guilford, and Forsyth in North Carolina, and of Patrick, Henry, Pittsylvania, Mecklenburg, and Halifax in Virginia.

Since 1939 no extensive surveys have been conducted. Numerous infested pack houses have been discovered, but none have been located outside the centers of infestation found in the surveys. Infested tobacco trash has been found in sales warehouses in Mullins, S. C., and Whiteville, N. C. Infestations were also noted in processing and storage plants in Fairmont, N. C., and Mullins, S. C. No pack-house infestations have been reported or discovered in the border tobacco belt.

FACTORS RESPONSIBLE FOR FARM INFESTATIONS

In most of the infestation centers it is very evident that certain conditions peculiar to these areas are responsible for the occurrence of the tobacco moth in pack houses. The most important factor is the presence of relatively large open-storage units in close proximity to growers' pack houses. These units are maintained by some of the large tobacco companies. In spite of the control measures usually practiced in these storages, large populations of moths develop, particularly during the spring and early summer when conditions for their development are not favorable in the pack houses. Many of the moths leave the storage units as a result of dusting with pyrethrum, and find their way to pack houses nearby; no doubt others leave the units voluntarily. The next spring there is a definite movement of the moths from the pack houses to the storage units. Such conditions are ideal from the standpoint of the insect, and all serious pack-house infestations can be attributed to this combination of circumstances.

Almost complete lack of sanitation in most of the pack houses is another important factor. The accumulation of tobacco scrap and trash by the end of the grading season, which provides food for the insect, assures the survival of maximum numbers of larvae. These larvae pass the winter in the pack house and develop into moths in the spring. The moths then lay eggs to produce another brood of larvae, or they fly to the storage units. Failure to dispose of tobacco scrap and trash, together with the rather general practice

of storing grains and miscellaneous livestock feed in the pack houses, serves as a means of perpetuating the infestation. It seems doubtful, however, that an infestation heavy enough to cause serious injury in the growers' pack houses could be maintained, except under unusually favorable conditions, if the open-storage units were not present in the immediate vicinity to function as the principal source of infestation.

The practice of buying scrap tobacco from widely scattered areas and collecting it in one locality for processing has been found responsible for at least one center of infestation. The screenings and trash obtained from the processing are spread as fertilizer on the fields of neighboring farms, and frequently infestations are established.

Appreciable quantities of tobacco are often carried from one district to another to be sold on the market. The transfer of infested tobacco to uninfested districts is a dangerous practice. Infested tobacco that does not sell readily on the market is often purchased by speculators, who regrade it and place it on the auction floor for sale. Frequently this regrading is done by local growers in their pack houses. At least one center of infestation has been attributed to this practice.

Information collected thus far indicates that populations of the tobacco moth will fluctuate greatly from year to year, depending on whether conditions are favorable for the development of the insect. The absence of a serious infestation for a year or two may not always indicate that the insect causing the infestation is under control. Cured tobacco is moved about frequently in all tobacco-growing districts, and accumulations of such infested tobacco over a period of years in any farming locality may result in a sporadic outbreak of the pest.

GENERAL DESCRIPTION AND HABITS 2/

The adult tobacco moths, commonly referred to as candleflies, are small, gray or grayish-brown moths similar to those seen frequently in rooms where livestock feeds are stored. Usually they are present in or near farm pack houses during July or August, at the time the first cured tobacco is bulked down (i. e., placed in piles). The eggs are deposited on or near the cured tobacco. The

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2/ Additional information on the life history and habits of the tobacco moth may be obtained by consulting U. S. Dept. Agr. Cir. 422, entitled "Biology of the tobacco moth and its control in closed storage."

larvae, or "worms," hatching from these eggs feed on the cured tobacco leaves. When full-grown the larvae are approximately one-half inch in length. They vary in color from creamy white to brown, and they usually have a pink tinge. The majority of the larvae are full-grown, or at least more than half-grown, at the time the tobacco is graded, in September or October. At this time they crawl into cracks in the floor and walls, or other protected places, where they encase themselves in cocoons and pass the winter. Corrugated cardboard, piles of lumber, and empty bags or boxes are particularly favorable places for the larvae to overwinter. In the spring the larvae enter the pupal stage and later emerge as moths, usually early in May in the districts under observation. If suitable food is available in or near the pack houses, the moths lay their eggs on such food, and the larvae develop to produce another brood of moths early in July. The most favorable period for development of the insect in pack houses is from the middle of July, when new tobacco is introduced, until the end of September. During September the moths may be present in large numbers.

During May and June only limited quantities of a food supply suitable for the moth are present in the pack houses, and usually large populations of the tobacco moth do not develop. The enormous quantities of tobacco in open storage units nearby attract many of the moths emerging in the pack houses at this time. By July the moth populations in the storage units become heavy, and attempts are made to control the infestation. The usual measures consist in the use of a pyrethrum-dust mixture, which tends to drive the moths to the pack houses where conditions are more favorable. Evidence obtained substantiates the theory that most of the moths suddenly appearing in the pack houses in July originated in the storage units.

CHARACTER OF DAMAGE

Damage caused by the tobacco moth is important from the standpoint of the tobacco actually consumed, the lowering of the quality due to webbing and accumulations of frass, and possible discrimination against tobacco showing evidence of infestation on the auction floors. The larvae prefer the better grades of tobacco and are found feeding most frequently on the first three primings. Instances have been encountered in heavily infested pack houses where the entire contents of a curing barn have been a total loss. Frequently the contents of a curing barn consist of one priming, and in a single pack house approximately 800 pounds of tobacco, consisting of one priming of the better grades, were destroyed. Since the larvae feed in protected places, the first evidence of injury is apt to be found within and near the bottom of the tobacco bulks. When infestations are heavy, the entire leaf is eaten with the exception of the large veins and midrib. Excrement adheres to the webs formed by the larvae, and produces

an unsightly appearance even though only a small portion of leaf surface is eaten. Frequently the tobacco becomes infested while it is held in the pack house after being graded and tied. Such tobacco has been refused at the sales warehouse, probably owing to the fear of infestations in storage. However, the redrying process to which most of the tobacco is subjected before being packed in hogsheads should kill all stages of the insect.

RECOMMENDED CONTROL MEASURES

Screening of Storage Units

Inasmuch as all tobacco moth infestations of economic importance have been found in districts where open tobacco-storage units have been maintained in close proximity to farms, the most important control measure is the screening of these storage buildings. The benefit to be derived from this procedure has been demonstrated in several heavily infested districts. It is advantageous from the standpoint of both the broker or company owning the storages and the tobacco grower, because the moths move back and forth between the pack houses and the storage units.

Pack-House Sanitation

A great deal can be accomplished by proper maintenance of the pack house. Early grading and sale of the infested tobacco is important. This practice reduces the loss of valuable tobacco and stops the progress of the infestation, thus lowering the tobacco moth population in the pack house. As soon as an appreciable amount of tobacco scrap and trash accumulates, it should be disposed of by sale, by burning, or by scattering thinly on the fields to serve as a fertilizer. Piles of tobacco trash should not be allowed to remain on the farm. Crops or livestock feeds should not be stored in pack houses, since some of these commodities furnish food for the larvae in the spring. The pack house should be cleaned thoroughly as soon as possible after the tobacco is sold, to eliminate any possible food for the insect. A well-cleaned pack house will offer little attraction to moths emerging in the spring.

Direct Control Measures

The use of a pyrethrum-oil spray[3/] at the time the moths are observed in the pack house is of practical value if done thoroughly. Several brands suitable for this purpose are available

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3/ Wartime conditions have led to certain restrictions on the use of pyrethrum insecticides, and these restrictions are subject to change dependent upon the supply. For up-to-date information on the subject consult the War Food Administration, Office of Materials and Facilities, Washington, D. C.

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on the market. They should be used according to the directions on the container. If desired, a pyrethrum-oil spray may be made up by mixing 7 parts of white oil (a highly refined petroleum oil, viscosity 85 seconds Saybolt at 100° F.) and 1 part of pyrethrum extract (pyrethrin content not less than 2.0 percent). This spray contains approximately 0.25 percent of pyrethrins, and is relatively noninflammable. It should be applied as a very fine mist and directed to places in the pack house where the presence of the moths is known or suspected.

Covering bulks of tobacco with a good grade of plant-bed cloth free from holes will protect the tobacco from infestation if certain precautions are taken. The cloth should be tucked in carefully around the base of the bulks so that the moths will not be able to enter. Every 4 or 5 days during warm weather, and once a week after September 15, the cloth should be removed and treated with boiling water so as to destroy any eggs deposited thereon. The cloth should be removed carefully to avoid shaking off some of the eggs in the pack house.

When infestations in tobacco bulks are heavy, the damage may be checked by reheating the tobacco in the curing barns. The larvae and eggs of the tobacco moth will be killed if the temperature in the curing barns is allowed to rise slowly until it reaches 140° to 150° F. after 8 to 10 hours. This method is not considered desirable, however, and should not be necessary if the previously recommended precautions are taken.

PRACTICES TO BE AVOIDED

There are certain practices common in some tobacco districts that should be avoided. Infested tobacco should not be transported into uninfested districts to be sold on the auction markets. In most warehouses conditions are favorable for the perpetuation of an infestation, and sooner or later some of the infested tobacco, either as trash or low-grade leaf, is likely to be tranported to neighboring farms. A focus of infestation could thus be started which might result in serious loss if the right combination of circumstances were encountered.

The practice of carrying unacceptable tobacco from auction warehouses to the farm for regrading is another way of establishing a focus of infestation. Often the tobacco that does not sell readily is infested by the tobacco moth.

Scrap tobacco collected from widely scattered areas and concentrated in one place for processing is almost certain to include infested lots. If the refuse resulting from the processing is taken to farms and deposited in piles, a large population of moths may develop to infest pack houses nearby.